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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/817,193	04/02/2004	Anna M. Minvielle	H1624	2166

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RENNER, OTTO, BOISSELLE & SKLAR, LLP (AMDS)  
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CLEVELAND, OH 44115-2191

EXAMINER
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RAYMOND, BRITTANY L

ART UNIT	PAPER NUMBER
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1756

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	03/30/2007	PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

**Office Action Summary**

Application No.

10/817,193

Applicant(s)

MINVIELLE ET AL.

Examiner

Brittany Raymond

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) 14 and 17-20 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-13, 15 and 16 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 4/2/2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date 7/7/2004/4/17/2006.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_.
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_.

**DETAILED ACTION**

***Election/Restrictions***

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:
  - I. Claims 1-13, 15, and 16, drawn to a method, classified in class 430, subclass 311.
  - II. Claim 14, drawn to a device, classified in class 257, subclass 618.
  - III. Claims 17-20, drawn to a structure, classified in class 353, subclass 75.

The inventions are distinct, each from the other because of the following reasons:

Inventions I and II are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make another and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case the product as claimed can be made by another and materially different process such as a single dipole or quadrupole illumination process.

Inventions I and III are related as process and apparatus for its practice. The inventions are distinct if it can be shown that either: (1) the process as claimed can be practiced by another and materially different apparatus or by hand, or (2) the apparatus as claimed can be used to practice another and materially different process. (MPEP § 806.05(e)). In this case the process as claimed can be practiced by another and

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materially different apparatus, such as a an aperture plate with a single dipole or quadrupole illumination source.

Inventions III and II are related as apparatus and product made. The inventions in this relationship are distinct if either or both of the following can be shown: (1) that the apparatus as claimed is not an obvious apparatus for making the product and the apparatus can be used for making a materially different product or (2) that the product as claimed can be made by another and materially different apparatus (MPEP § 806.05(g)). In this case the product as claimed can be made by another and materially different apparatus, such as an illumination system without an aperture plate.

Because these inventions are independent or distinct for the reasons given above and there would be a serious burden on the examiner if restriction is not required because the inventions have acquired a separate status in the art due to their recognized divergent subject matter, restriction for examination purposes as indicated is proper.

2. During a telephone conversation with Mr. Jason A. Worgull on 3/14/2007 a provisional election was made without traverse to prosecute the invention of Group I, claims 1-13, 15, and 16. Affirmation of this election must be made by applicant in replying to this Office action. Claims 14 and 17-20 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

3. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one

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or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

***Claim Rejections - 35 USC § 112***

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 2, 7, and 13 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

As to claims 2 and 13, the recited format does not comply with accepted U.S. Patent practice with regard to the recitation of Markush grouping of claim elements. Phrases using "comprising" should recite elements in the alternative (i.e. "comprising A, B, C or D"), whereas closed sets ("consisting of") should recite elements as "selected from the group consisting of A, B, C and D." In the instant case, the phrase "have at least one of" is interpreted as open language, similar to "comprising" (See MPEP 2173.05 (h)).

Regarding claim 7, there are no units listed for the diameter of the contact holes. For the purpose of examination, it will be assumed by the examiner that the units are nanometers.

***Claim Rejections - 35 USC § 102***

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

7. Claims 1-3, 5, 6, 9, 10, 12, and 13 are rejected under 35 U.S.C. 102(b) as being anticipated by Wang (U.S. Patent 6261727).

Wang discloses a process for patterning a substrate comprising: forming contact holes in a photoresist layer that consist of both isolated and densely packed contact holes, and etching this pattern into the substrate located below the photoresist layer (Column 3, Lines 15-19), as claimed in claim 1 of the present invention. Wang also discloses that the contact holes of each type are spaced appropriately, with one being spaced farther apart than the other (Column 4, Lines 12-17), as recited in claims 1 and 5 of the present invention. Wang states that the regularly spaced contact holes are separated by about 180-360 nm (Column 4, Lines 15-17), as recited in claim 6 of the present invention. Wang discloses that a quadrupole filter is used to transmit light through a reticle having a pattern to be imaged onto the photoresist layer (Column 3-4, Lines 66-67, 1-10). The examiner is considering a quadrupole filter to be equivalent to two dipole filters placed together, as recited in claim 1 of the present invention. This also means that the apertures are exposed simultaneously, as recited in claim 10 of the present invention. Wang states that the quadrupole filter is arranged so that it works for horizontal and vertical arrays of the contact holes (Column 4, Lines 63-64), as recited in

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claims 1 and 3 of the present invention. Wang also states that the filter can include annular sectors (Column 4, Lines 53-54), as recited in claim 12 of the present invention, and that the annular sectors can have sizes within a certain range (Column 4, Lines 54-59), as recited in claims 2 and 13 of the present invention. Finally, Wang discloses that the process uses a single exposure step (Column 3, Line 17), as recited in claim 9 of the present invention.

Wang teaches every limitation of claims 1-3, 5, 6, 9, 10, 12, and 13 and thus anticipates the claims.

***Claim Rejections - 35 USC § 103***

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

9. Claims 4 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang (U.S. Patent 6261727) in view of Socha (U.S. Patent Application 2002/0152452).

The teachings of Wang have been discussed in paragraph 7 above.

Wang fails to disclose the equations used for finding the aperture spacing and that a binary mask is used.

Socha discloses a mathematical model for imaging a pattern onto a substrate comprising the use of the equations in Figure 1 to determine spacing between features of an illumination system, as recited in claim 4 of the present invention. Socha also discloses that typical mask types used to transfer patterns onto a substrate are binary, alternating phase shift and attenuated phase shift masks (Paragraph 0007), as recited in claim 11 of the present invention.

It would have been obvious to one of ordinary skill in this art, at the time of invention by applicant, to have used the equations suggested by Socha in the process of Wang because Socha teaches that these equations are used in order to align the illumination system correctly so that the substrate can be patterned correctly and efficiently. It also would have been obvious to have used a binary mask, as suggested by Socha, because Socha teaches that this type of mask is normally used in this type of a process.

10. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wang (U.S. Patent 6261727) in view of Tanaka (U.S. Patent Application 2003/0207521).

The teachings of Wang have been discussed in paragraph 7 above.

Wang fails to disclose the diameter of regularly spaced contact holes.

Tanaka discloses a photolithographic method comprising the formation of contact holes, with diameters of 150 nanometers, on a photoresist layer (Paragraph 0200), as recited in claim 7 of the present invention.



It would have been obvious to one of ordinary skill in this art, at the time of invention by applicant, to have used the diameter of contact holes, as suggested by Tanaka, in the process of Wang because Tanaka teaches that typical diameters of contact holes, in this type of process, fall within a range around this number.

11. Claims 8 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang (U.S. Patent 6261727) in view of Kawashima (U.S. Patent Application 2004/0057036).

The teachings of Wang have been discussed in paragraph 7 above.

Wang fails to disclose the pitch between semi-isolated contact holes and that a plurality of irregularly spaced contact holes are illuminated onto a periphery region of the substrate by a low sigma illumination source through a second mask.

Kawashima discloses an exposure method comprising illuminating a contact hole pattern onto a substrate with the hole pitch in a lateral direction being 180 nm and the hole pitch in a longitudinal direction being 360 nm (Paragraph 0099), as recited in claim 8 of the present invention. Kawashima also discloses that when a small sigma illumination is used, the beams can be diffracted from the normal area on the substrate (Paragraph 0082), which could be the periphery of the substrate, as recited in claim 15 of the present invention. It would be obvious to one of ordinary skill in this art to provide a second mask with a different pattern in order to produce the irregularly spaced contact holes, as recited in claim 15 of the present invention.

It would have been obvious to one of ordinary skill in this art, at the time of invention by applicant, to have used the pitch, as suggested by Kawashima, in the

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process of Wang because Kawashima teaches that there can be a pitch within this range in this type of process. It also would have been obvious to use a low sigma illumination source, as suggested by Kawashima because Kawashima teaches that this type of illumination allows patterns to be illuminated onto other portions of the substrate that are not usually patterned.

12. Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wang (U.S. Patent 6261727) in view of Kawashima (U.S. Patent Application 2004/0057036) as applied to claims 1 and 15 above, and further in view of Socha (U.S. Patent Application 2002/0152452).

The teachings of Wang and Kawashima have been discussed in paragraphs 7 and 11 above.

Wang and Kawashima fail to disclose that the second mask is a six percent attenuated phase shift mask.

Socha discloses that typical mask types used to transfer patterns onto a substrate are binary, alternating phase shift and attenuated phase shift masks (Paragraph 0007), as recited in claim 16 of the present invention

It would have been obvious to one of ordinary skill in this art, at the time of invention by applicant, to have used a type of attenuated phase shift mask, as suggested by Socha, in the processes of Wang and Kawashima because Socha teaches that this type of mask is normally used in the type of photolithographic process disclosed in the present invention.


***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Brittany Raymond whose telephone number is 571-272-6545. The examiner can normally be reached on Monday through Friday, 8:00 a.m. - 4:30 p.m. EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Huff can be reached on 571-272-1385. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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KATHLEEN DUDA  
PRIMARY EXAMINER

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